

## AMENDMENTS TO CLAIMS

*The following listing of the claims replaces all prior claim versions and listings.*

**1. (Canceled)**

**2. (Currently Amended)** A fingerprint authentication method as ~~claimed in Claim 1 comprising,~~  
~~wherein said second step comprises:~~

a first step of collating features of input data based on a fingerprint input by a user with features of enrolled data;

a second step of judging whether the input data are proper for authentication or not, said judging comprising a forth step of deciding an observation line on the an input image; finding a pair of peak envelopes each of which links local maximums or local minimums on a graph of brightness against positions on the observation line; calculating discriminative values on the basis of the peak envelopes, said discriminative values representing features of the spatial distribution of the brightness; and a seventh step of deciding whether the input data are proper for the authentication or not on the basis of the discriminative values; and

a third step of authenticating the input data according to results of said first step and said second step; wherein

said second step is done on the basis of a spatial distribution of brightness in the input image represented by the input data.

**3. (Currently Amended)** A fingerprint authentication method as claimed in Claim 2, wherein ~~said seventh step deciding whether the input data are proper is done by the use of~~ using one or more discriminants and corresponding discriminative coefficients which are previously calculated.

**4. (Currently Amended)** A fingerprint authentication method as claimed in Claim 2, wherein said ~~fourth step~~ deciding an observation line on the input image comprises:

~~an eighth step of finding a fingerprint center and a fingertip direction on the input image;~~  
and

~~a ninth step of~~ assuming two imaginary lines on the input image, one of said imaginary lines being parallel to the fingertip direction and used as the observation line, the other of said imaginary lines being perpendicular to the fingertip direction and used for another observation line.

**5. (Currently Amended)** A fingerprint authentication method as claimed in Claim 2, wherein said ~~fifth step~~ finding the pair of peak envelopes is done on the condition that a distance between adjacent local maximums or adjacent local minimums is larger than a predetermined distance.

**6. (Original)** A fingerprint authentication method as claimed in Claim 5, wherein said predetermined distance is corresponding to an average ridge interval of a large number of samples.

**7. (Original)** A fingerprint authentication method as claimed in Claim 5, wherein said predetermined distance is corresponding to an average ridge interval calculated by applying Fourier transformation to a plurality of areas of the input image.

**8. (Currently Amended)** A fingerprint authentication method as claimed in Claim 2, wherein said ~~sixth step~~ calculating discriminative values is done on the basis of a spatial distribution function representing brightness against positions on the observation line, peak envelope functions representing said peak envelopes.

**9. (Currently Amended)** A fingerprint authentication method as claimed in Claim 2, further comprising:

~~a tenth step of requesting the user to input the fingerprint once more when deciding whether the input data are proper decides decision that the input data are not proper is made at said seventh step.~~

**10. (Canceled)**

**11. (Currently Amended)** A computer readable program, stored on a computer readable medium, generating instructions to perform the following, comprising: as claimed in Claim 10, wherein said second step comprises:

a first instruction for collating features of input data based on a fingerprint input by a user with features of enrolled data;

a second instruction for judging whether the input data are proper for authentication or not, said judging comprising a forth step of deciding an observation line on the an input image; finding a pair of peak envelopes each of which links local maximums or local minimums on a graph of brightness against positions on the observation line; calculating discriminative values on the basis of the peak envelopes, said discriminative values representing features of the spatial distribution of the brightness; and a seventh step of deciding whether the input data are proper for the authentication or not on the basis of the discriminative values; and

a third instruction for authenticating the input data according to results of said first instruction and said second instruction; wherein

said second instruction is done on the basis of a spatial distribution of brightness in the input image represented by the input data..

**12. (Currently Amended)** A computer readable program as claimed in Claim 11, wherein said ~~seventh step deciding whether the input data are proper~~ is done ~~by the use of~~ fusing one or more discriminants and corresponding discriminative coefficients which are previously calculated.

**13. (Currently Amended)** A computer readable program as claimed in Claim 11, wherein said ~~forth step~~ deciding an observation line comprises:

~~an eighth step of~~ finding a fingerprint center and a fingertip direction on the input image;  
and

~~a ninth step of~~ assuming two imaginary lines on the input image, one of said imaginary lines being parallel to the fingertip direction and used as the observation line, the other of said imaginary lines being perpendicular to the fingertip direction and used for another observation line.

**14. (Currently Amended)** A computer readable program as claimed in Claim 11, wherein said ~~fifth step~~ finding the pair of peak envelopes is done on the condition that a distance between adjacent local maximums or adjacent local minimums is larger than a predetermined distance.

**15. (Original)** A computer readable program as claimed in Claim 14, wherein said predetermined distance is corresponding to an average ridge interval of a large number of samples.

**16. (Original)** A computer readable program as claimed in Claim 14, wherein said predetermined distance is corresponding to an average ridge interval calculated by applying Fourier transformation to a plurality of areas of the input image.

**17. (Currently Amended)** A computer readable program as claimed in Claim 11, wherein said ~~sixth step~~ calculating discriminative values is done on the basis of a spatial distribution function representing brightness against positions on the observation line, peak envelope functions representing said peak envelopes.

**18. (Currently Amended)** A computer readable program as claimed in Claim 11, further comprising:

~~a tenth step of requesting the user to input the fingerprint once more when decision that deciding whether the input data are proper decides the input data are not proper is made at said seventh step.~~

**19. (Canceled)**

**20. (Currently Amended)** A fingerprint authentication device ~~as claimed in Claim 19, wherein said characteristic judging portion comprises~~ comprising:

a collating portion for collating features of input data based on a fingerprint input by a user with features of enrolled data;

a characteristic judging portion for judging whether the input data are proper for authentication or not, comprising:

an observation line deciding portion for deciding an observation line on the an input image;

a peak envelope calculating portion for finding a pair of peak envelopes each of which links local maximums or local minimums on a graph of brightness against positions on the observation line;

a discriminative value calculating portion for calculating discriminative values on the basis of the peak envelopes, said discriminative values representing features of the spatial distribution of the brightness; and

a deciding portion for deciding whether the input data are proper for the authentication or not on the basis of the discriminative values; and

an authenticating portion for authenticating the input data according to outputs from said collation portion and said characteristic judging portion; wherein

said characteristic judging portion uses a spatial distribution of brightness in the input image represented by the input data to judge whether the input data are proper for authentication or not.

**21. (Original)** A fingerprint authentication device as claimed in Claim 20, further comprises a discriminative coefficient holding portion for holding one or more discriminants and corresponding discriminative coefficients which are previously calculated by the use of said discriminants, wherein

said deciding portion uses said discriminants and said discriminative coefficients together with the discriminative values to decide whether the input data are proper for the authentication or not.

**22. (Original)** A fingerprint authentication device as claimed in Claim 20, wherein said observation line deciding portion executes of the steps of:

finding a fingerprint center and a fingertip direction on the input image; and

assuming two imaginary lines on the input image, one of said imaginary lines being parallel to the fingertip direction and used as the observation line, the other of said imaginary lines being perpendicular to the fingertip direction and used for another observation line.

**23. (Currently Amended)** A fingerprint authentication device as claimed in Claim 20, wherein said peak envelope calculating portion adopts a condition that a distance between adjacent local maximums or adjacent local minimums is larger than a predetermined distance.

**24. (Original)** A fingerprint authentication device as claimed in Claim 23, wherein said predetermined distance is corresponding to an average ridge interval of a large number of samples.

**25. (Original)** A fingerprint authentication device as claimed in Claim 23, wherein said predetermined distance is corresponding to an average ridge interval calculated by applying Fourier transformation to a plurality of areas of the input image.

**26. (Original)** A fingerprint authentication device as claimed in Claim 20, wherein a discriminative value calculating portion calculates the discriminative values by the use of a spatial distribution function representing brightness against positions on the observation line, peak envelope functions representing said peak envelopes.

**27. (Original)** A fingerprint authentication device as claimed in Claim 20, wherein said authenticating portion requests the user to input the fingerprint once more when the input data are not proper.